

Code: 23HS1403

**II B.Tech - II Semester – Supplementary Examinations  
DECEMBER 2025**

**OPTIMIZATION TECHNIQUES  
(Common for IT, AIML, DS)**

Duration: 3 hours

Max. Marks: 70

- Note: 1. This question paper contains two Parts A and B.  
 2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.  
 3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.  
 4. All parts of Question paper must be answered in one place.

**PART – A**

1.a)	What is degeneracy in simplex?
b)	Write about pivot element in a simplex table.
c)	How to convert unbalanced assignment problem into balanced assignment problem.
d)	Discuss about initial feasible solution in Transportation problem.
e)	Write a short note on sequencing decision problem for n jobs, 2 - machines.
f)	Explain about CPM.
g)	Explain the significance of economic order quantity in inventory.
h)	Discuss various costs involved in Break-even-analysis.
i)	Define pure strategy and mixed strategy.
j)	List the characteristics of game theory.

**PART – B**

		Max. Marks
<b>UNIT-I</b>		
2	<i>Maximize</i> $z = 5x_1 + 3x_2$ subject to $3x_1 + 5x_2 \leq 15, 5x_1 + 2x_2 \leq 10$ and $x_1, x_2 \geq 0$	10 M
<b>OR</b>		

3	<p>Maximize <math>z = 8x_1 + 19x_2 + 7x_3</math> subject to</p> <p><math>3x_1 + 4x_2 + x_3 \leq 25</math>, <math>x_1 + 3x_2 + 3x_3 \leq 50</math> and <math>x_1, x_2, x_3 \geq 0</math></p>	10 M
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**UNIT-II**

4	<p>Determine an optimal solution to the following Transportation problem.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>D<sub>1</sub></th> <th>D<sub>2</sub></th> <th>D<sub>3</sub></th> <th>D<sub>4</sub></th> <th>Supply</th> </tr> </thead> <tbody> <tr> <th>O<sub>1</sub></th> <td>13</td> <td>11</td> <td>15</td> <td>20</td> <td>2000</td> </tr> <tr> <th>O<sub>2</sub></th> <td>17</td> <td>14</td> <td>12</td> <td>13</td> <td>6000</td> </tr> <tr> <th>O<sub>3</sub></th> <td>18</td> <td>18</td> <td>15</td> <td>12</td> <td>7000</td> </tr> <tr> <th>Demand</th> <td>3000</td> <td>3000</td> <td>4000</td> <td>5000</td> <td></td> </tr> </tbody> </table>		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	Supply	O <sub>1</sub>	13	11	15	20	2000	O <sub>2</sub>	17	14	12	13	6000	O <sub>3</sub>	18	18	15	12	7000	Demand	3000	3000	4000	5000		10 M
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**OR**

5	<p>Five men are available to do five different jobs. From past records, the time (in hrs.) that each man takes to do each job is known and given in the following table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2" style="writing-mode: vertical-rl; transform: rotate(180deg);">Man</th> <th colspan="5">Job</th> </tr> <tr> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th>V</th> </tr> </thead> <tbody> <tr> <th>A</th> <td>2</td> <td>9</td> <td>2</td> <td>7</td> <td>1</td> </tr> <tr> <th>B</th> <td>6</td> <td>8</td> <td>7</td> <td>6</td> <td>1</td> </tr> <tr> <th>C</th> <td>4</td> <td>6</td> <td>5</td> <td>3</td> <td>1</td> </tr> <tr> <th>D</th> <td>4</td> <td>2</td> <td>7</td> <td>3</td> <td>1</td> </tr> <tr> <th>E</th> <td>5</td> <td>3</td> <td>9</td> <td>5</td> <td>1</td> </tr> </tbody> </table> <p>Find the assignment of men to jobs that will minimize the total time taken.</p>	Man	Job					I	II	III	IV	V	A	2	9	2	7	1	B	6	8	7	6	1	C	4	6	5	3	1	D	4	2	7	3	1	E	5	3	9	5	1	10 M
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**UNIT-III**

6	<p>Determine the sequence of the jobs that will minimize the total elapsed time. Also find the idle times of machines.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Job</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> </tr> </thead> <tbody> <tr> <th>Machine M<sub>1</sub></th> <td>2</td> <td>5</td> <td>4</td> <td>9</td> <td>6</td> <td>8</td> <td>7</td> <td>5</td> <td>4</td> </tr> <tr> <th>Machine M<sub>2</sub></th> <td>6</td> <td>8</td> <td>7</td> <td>4</td> <td>3</td> <td>9</td> <td>3</td> <td>8</td> <td>11</td> </tr> </tbody> </table>	Job	1	2	3	4	5	6	7	8	9	Machine M <sub>1</sub>	2	5	4	9	6	8	7	5	4	Machine M <sub>2</sub>	6	8	7	4	3	9	3	8	11	10 M
Job	1	2	3	4	5	6	7	8	9																							
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**OR**

7	<p>A small marketing project consists of the jobs in the table given below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Job</th> <th style="text-align: center;">Normal duration (in days)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">(1 – 2)</td> <td style="text-align: center;">9</td> </tr> <tr> <td style="text-align: center;">(1 – 3)</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;">(1 – 4)</td> <td style="text-align: center;">15</td> </tr> <tr> <td style="text-align: center;">(2 – 4)</td> <td style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">(3 – 4)</td> <td style="text-align: center;">10</td> </tr> <tr> <td style="text-align: center;">(4 – 5)</td> <td style="text-align: center;">2</td> </tr> </tbody> </table> <p>Draw the Network and Calculate the minimum project duration.</p>	Job	Normal duration (in days)	(1 – 2)	9	(1 – 3)	8	(1 – 4)	15	(2 – 4)	5	(3 – 4)	10	(4 – 5)	2	10 M
Job	Normal duration (in days)															
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(4 – 5)	2															

**UNIT-IV**

8	<p>An aircraft uses rivets at an approximately constant rate of 5,000kg. per year. The rivets cost Rs. 20 per kg. and the company personnel estimate that it costs Rs. 200 to place an order and the carrying cost of inventory is 10% per year.</p> <p>(i) How frequently should orders for rivets be placed and what quantities should be ordered for?</p> <p>(ii) If the actual costs are Rs. 500 to place an order and 15% for carrying cost, the optimum policy will change. How much is the company losing per year because of imperfect cost information?</p>	10 M
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**OR**

9	<p>A company requires 10000 units of an item per annum. The cost of ordering is Rs 1000 per order. The inventory carrying cost is 20% of the unit price per annum. The unit price of the item is Rs. 100. Calculate</p> <p>(i) Economic order quantity</p> <p>(ii) Optimal total annual cost</p> <p>(iii) Time between the orders.</p>	10 M
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